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Design Approval Smart Application for Dubai Electricity installations (DASA-DUBAI)

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RIT

Design Approval Smart Application for Dubai Electricity installations (DASA-DUBAI)

by

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A Graduate Capstone Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Science in City Science

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Master of Science in
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Graduate Capstone Approval

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Graduate Capstone Title**: Design Approval Smart App for Dubai Electricity installations (DASA-DUBAI)**

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Abstract

Design Approval smart application for assure the healthy and safety installations for buildings and properties in Dubai using programming and automations. It will enable the engineers in the concerned departments to have effective use of time and effort through having automatic first line defends reviewing the submissions of the electrical engineers contractors/ consultants who will be referred to as customers through the project description. The application will be a data base that carries the original standards and regulations that related to the installations of the electricity wiring in the government of Dubai. That kind of information's are already distributed as written documents in both hard/soft copies. Having such a general standards and regulations that been updated every couple of years made it such a hard time to the customers to follow up. Also, in the same time it's difficult to the customer to submit the correct submission from the first time trail to the concern department of electricity.

This application will have the support of the city strategies in adaptation of the digital tools and program in order to be the masters in the digital transformation in the world. We are aligned with the fast improvement of the technologies all over the world. We will focused on the elements of how we can enable the software with the current/modification of hardware along with the networks and the rapidly increase of the data are pervading the business world quickly, deeply and broadly. In same time we will not neglecting the faster environment developments that the city is looking forwards such as the interfacing the machine learning and the Arterial intelligence in all industrial and governmental aspects.

Moreover, the application will be as guidance tools to the upcoming business companies that would be establishing new business in Dubai. They will find the smart and digital way to know about the regulations and standards in more professional ways.

However, the government employee will be able to have more control in the productivity through the day. It's by having the first line defense ready as the machine dealing with the initial phase of the approval procedures. That will give him the power to use the time effectively. Moreover, transfer him to more powerful employee with skills to improve and modified some of the features that it's already in the system. Having to learn about the system and observer of the how the application is working and give some

enhancement. Which make him part of continues development in the application will increase his involvements and commitment to success of the application. That have different angle of the technology and how it will affect the social aspects too.

The application will have the options to view the measurements of the electrical equipments and 2-3 dimensions of the sites to give fulfill views to the engineers how setting in the disk in his company. Moreover, the application will show some of the ideal projects tablets to make it easy to the customer to follow up with the types of their projects such as: if the project building is existing for 30 years ago and some modification will be done as a renovation. As customers concerned about the budget and the way he can make the job done with least changes. More over as a government utility we study the cases as individual to safe the network and the safety of the resident primary. This is to be some of the challenges that we will be discussing later through the project.

Chapter 1: Introduction and Background

In This chapter we will focused on the current challenges in the current procedures of having the initial approval for the electricity design in Dubai. After that we will state some of the similar project all over the world. Also, we will define the direction of the country towards the adapting the innovation and technologies. Why we have to implement such a tool/ programs. Moreover, we will specify the best parts of the normal procedure to implement the programming tools and automation to speed up with efficiency the approval procedure. Moreover we will highlight some of the important benefit for the application to both concerned the Government institution and the customers.

1.1 Problem Statement

The increase in the demand is to serve the customers in the faster and effective way always the need to create the best practices every year to be always in the leading countries in getting electricity applications. United Arab Emirates Represented by DEWA, have achieved the scores of 100% in all Getting Electricity indicators in the World Bank's Doing Business 2020 report [1]. The process of getting electricity is having the customer apply for the electricity from existing source of supply will take only 5 working days. This project calls "Al Namoos" [2]. It's applicable with the projects that have total connected load as 150KW and less. The need to be in the top of the world report is always need developments and

leading projects. The high management will ask to decrease that time to be one day or less in the coming years and to do that we will need some effective tools and the interface with the programming and automations. That why am introducing in this project the Design approval smart application.

1.2 History of project in worldwide and Needs for the automation

The Electrical installations should always follow the best practices and standards such as The International Electro-technical Commission IEC. That had a set of the written and diagrams that concerned about the Low –Voltage electricity design of the buildings. With the given written standards and regulation such as the International Standards IEC 60364 "Low voltage Electrical Installations" specifies extensively the rules to achieve the safety and correct operational functioning of all types of devices and equipments in the electrical installations. Moreover the challenges are not with the availability of the standards it's more than that. Every year there are new technologies and new devices manufactured with more advance feature the traditional way of installing the devices to keep the network safe is always required. The verity of the projects types and the connected device need continues updating the electrical engineer reviews. [3]

Dubai Electricity and Water authority had established a regulation book that is available for the customers/ builders to design their projects according to it. It's formulated beside on both the International Electromechanical Commission (IEC) documents and IET (The Institution of Engineering and Technology) wiring regulation. The book has a writing standards and graphical representation in 2D figures for the typical designs of Electrical rooms dimensions and the metering configurations and tables. That should be adjustable based on the design and the use of the building. It's generally stated in the book "The regulations are not intended to take the place of a detailed specification or to instruct untrained persons or to provide for every circumstance. Where a difficult or special situation arises which is not covered or allowed for in the regulations, DEWA may be sought to obtain specific advice." Which means the final decision to obtain the installation of the electrical design will lead for the LV-design engineer who work in DEWA to study each case separately and gives his comments and recommend it to the manager for the final approval. [4]

1.3 Unite Arab Emirates strategies and plans - Dubai strategies 2030-2050

Unite Arab Emirates has established the strategy of 2050 which is basically depends on the contribution of the clean energy in the higher scales of generating the power to reach up to 20-50% of the production of the powers that energize the country in the generation side. Which means new technologies will be adapting with new installation details and more standards and regulation to be modified and study.

So, what will be the effects of such a movement? to the term “end-users”? How the generation of power will affect the installations of the wiring?. The Energy Strategy 2050 of United Arab Emirates- Ministry of energy and industrial stated to increase the efficiency of the power to 40% effective. The efficiency will be affected in the smart grid challenges in the upcoming years. One of the important challenges is the multi diversity types of power connections from the end-line uses (Residences side) due to Solar panel generating power to the network in the opposite direction bidirectional way. Although, it has the increase usage of the Electrical cars and other similar projects that will affect the accuracy and the effectiveness of the network signals. New technology will be introduces with the less usage of power and reduction of sizes as needed so for that the flexibility in the rules and regulation should be within the scope of work and updated regularly. [5],[6]

1.4 Dubai Strategies for 2030-2050

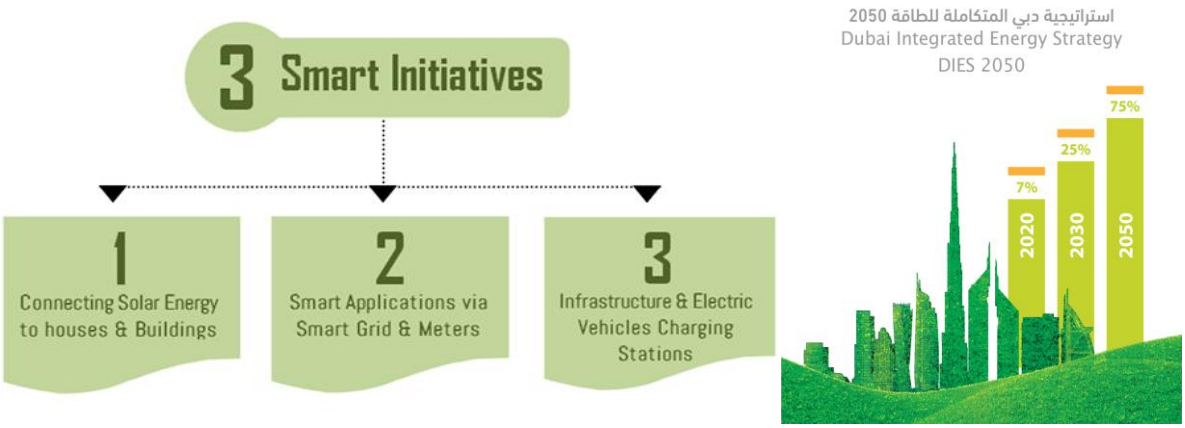


Figure-1: (Left) is the Three DEWA initiatives to support Dubai vision for the smart city. (Right) is the persentages of the clean energy contribution in Dubai 2020-2050

DEWA is energy services provider in the city of Dubai. It’s has initiatives to achieve the visions of the ruler of Dubai to support the economic growth. In the same side to focused in designing the reliable electrical infrastructure along with multi diversity sources of

energies. “Shams Dubai” is the initiative that allocated in all buildings to install solar panels in the roof top of their building by certified private companies in Dubai to encourage the citizen to adapt clean energy. [7]

1.5 Design Approval current procedure in the low –voltage installation

There are slight differences when they apply for the electricity connection installation due to the variety of project types such as: Fit-out application, solar connection application, Getting electricity new building, Additional load building, existing/ modified electricity connections …ect We will discuss The procedure of applying for the fit-out application.

Procedures are as following in DEWA website: First Fill-in the online application, second upload the documents listed, finally submits. While having a successful submission, then you will receive a reference number such as: F- “Numbers”, F: stand for Fit-out applications. [7]

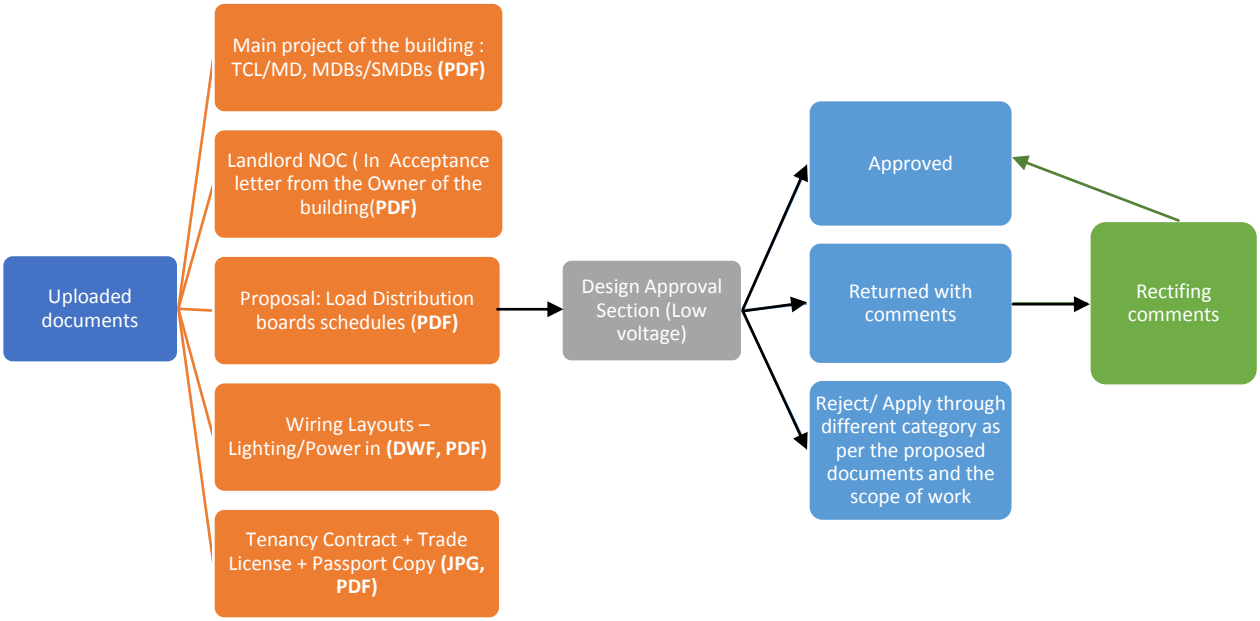


Figure-2 Flow chart – the process of applying application for the Fit-out application in DEWA. (DEWA, Getting Electricity Fit-Out Connections).[8]

1.6 The benefits of the application to customers

Some of the new companies don’t spend a proper time to understand DEWA regulation. Moreover, it can be because of the uniqueness of the proposed project. Dubai is hosting new and one of the kind types of projects continually. The returned cases with comments will be often which will delay the customer from starting up with project and

rectify the engineer concerned notes. With the automation the customer will be receiving the major comments and will give him the chance to modify his application before he gets to the concerned engineer for approval. This initial stage will enable the customer to clarify the doubts faster and automatically with the data base of the application and in same time will have the chance to get to some of the similar projects and review his submission. One to one with the machine data base rather having general comments after 2- 3 days (Depends on the type of the project).

1.7 The benefits of the application to the utilities that provide electricity services

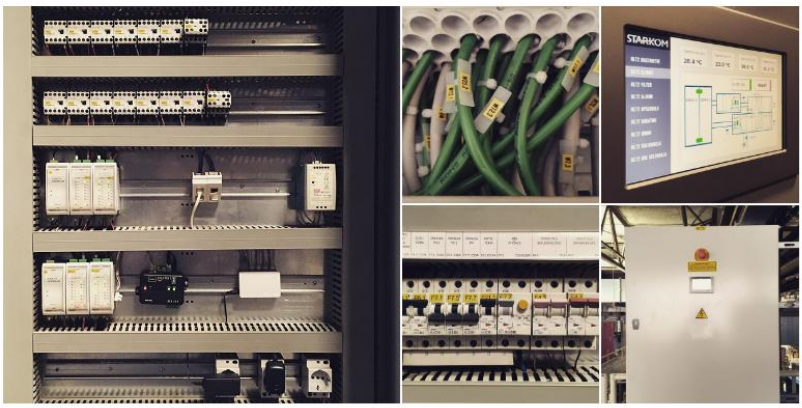
The Automated Design approval application will enable the employee to revise the applications in faster and effective way with the help of the programming. It can introduce a great opportunity for adapting the machine learning in the operational aspect in the government utilities especially in engineering. It will save effort and time for the engineer to work with more application per day. Moreover, It will develop the séance of programming and give him the time to develop the application and participate in other activates.

Chapter 2: Literature Review

In this chapter we will focus on the companies that had the advance features to support their products using the technologies. In the following chapter we will refer to such a mechanism of these projects and how can we adapt them to great our application for design approval.

2.1 Company had the automation and programming: Andivi

Andivi is a company that provides automation services for smart homes commercial building, hotels and schools act. They have introduce customize design and programs for the client through achieving best quality procedures following the international standards in installation wiring. They have in their website the electricity cabinet feature of their modules as a sample to their precise designs. They are promoting their company production for sensors, AC monitoring and automation solutions that certified by the CE. That is the CE logo represents approval for health, safety, and environmental protection standards for European Economic Area.



Control cabinets – components.

Figure-3 Andivi samples of the control cabinet –component and the wiring installations

They are using such technologies to market them self by providing customs services to the clients with different projects type. [10]

Figure-4: Electrical Installation Scheme for Hotel Rooms: Electrical Layout plan for a typical guest room.

2.2 Companies: that had the 3D features IKEA

IKEA is Furniture Retail Company based in European. It has a multinational group that sells ready-to-assemble furniture. Moreover, It's design all requirements of the homes applications such as kitchen appliances and home accessories. The founder is Ingvar Kamprad who is from Sweden in 1943. Since 2008 the company is classified as the world's largest furniture retailer.

2.2.1 The 3-D Applications for fitting the furniture in the room

IKEA has developed an application to help the buyers to visualize and understand the fitting dimensions in their room. Moreover, before they buy the furniture they will be able to imagine how it will fit in the room with respect to all other furniture in the room. The below figures are the example of the Kitchen fitting once it lunched.

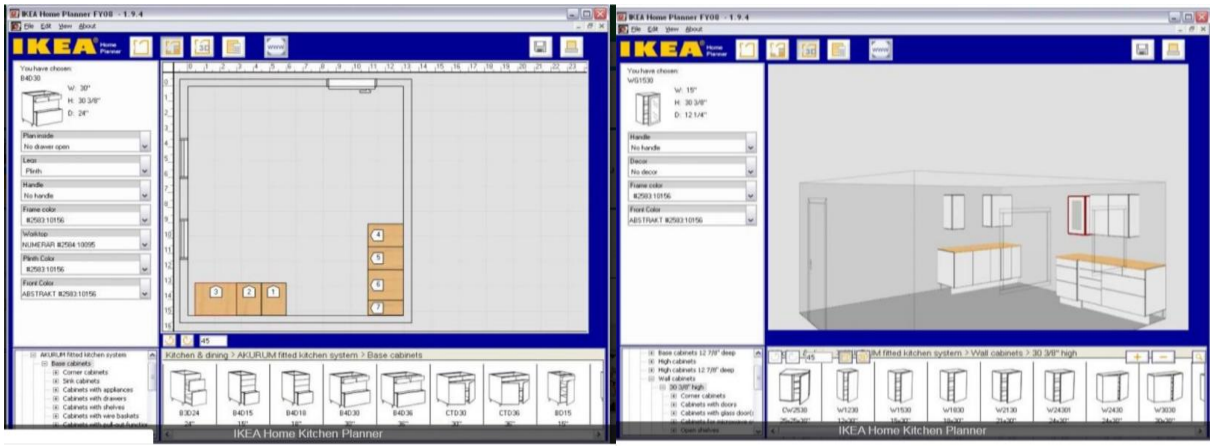
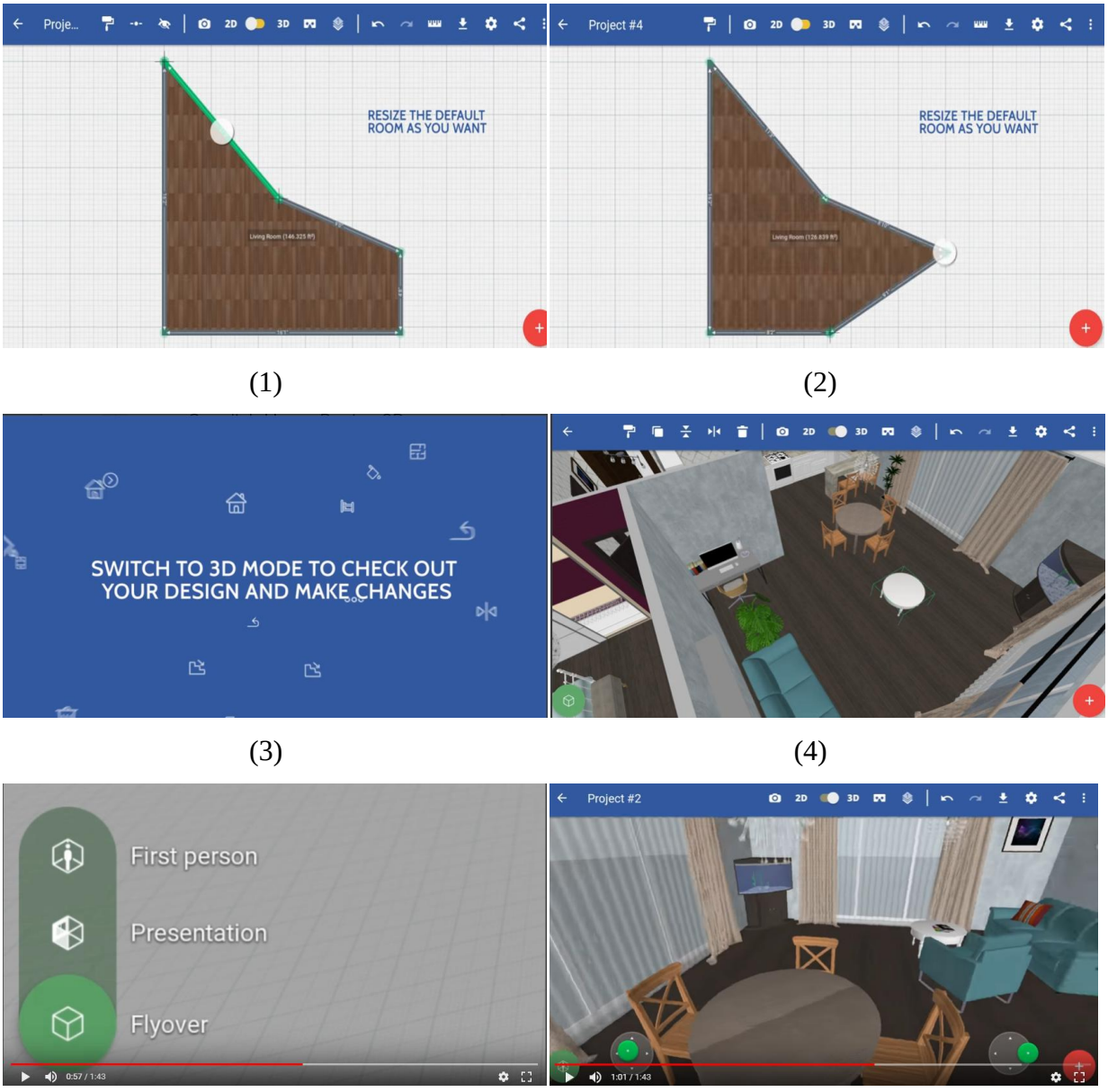


Figure-5: IKEA Interface of the 3D fitting of furniture –first edition

The application is available in the Android and the Apple software. It's free application the user can select which types of rooms that he would like to fit the furniture into and experience the 2-D & 3D option through their phones. That's allowed the flexibility and the mobility. Its enables all people to create realistic and beautiful home interior designs in 2D/ 3D HD modes.



(1) (2)

(3) (4)

(5) (6)

Figure-6: IKEA Interface of the 3D fitting of furniture tutorial –Latest edition

The tutorial is showing all the interesting feature that the phone application “Swedish Home Design 3D” by IKEA is offering such as: The resizing the room & flexibility to add many rooms adjacent Figure-6.1&2, the 2-D option to easy moving the furniture all over the place, 3-D option to actual life the experience figure-6.4&5 . Moreover, it has the flyover mode to go through the home such as Figure-6.5&6.[12]

2.3 Company that have the measuring tools (Measure the distance) – PhantomPDF

It’s a PDF Editor to help generating smart documents and enable to have flexible modification by computers and even by smart phones.

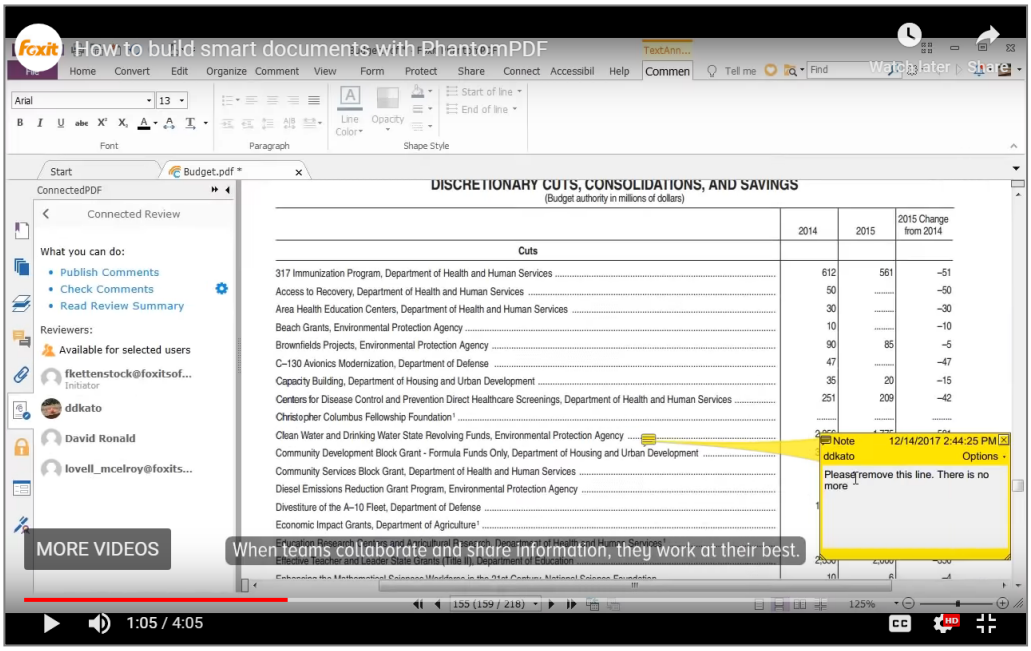


Figure -7 shows tools of the software to write and read and place comments that can be shared to the concerned party by phone easily

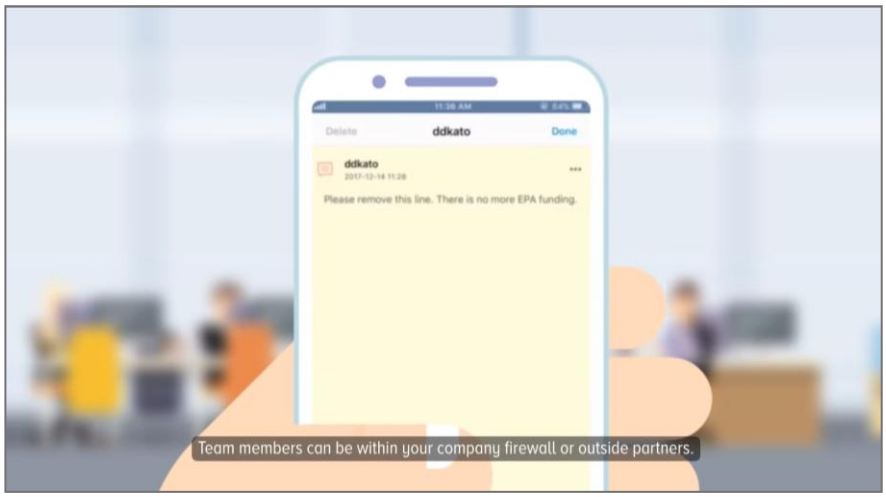


Figure -8 Comments that have easily received by phone

Moreover the software has the tool for measuring the distance by specifying the edges. The following is the interface page of the program.[13]

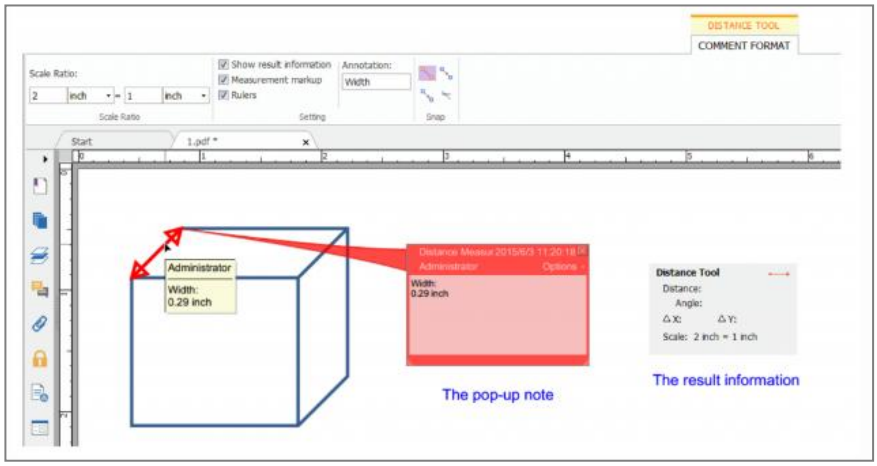


Figure- 9 the measurement tool that measures the distance in the PDF files

2.4 Software that highlight the copied words (Turnitin® Similarity)

The Turnitin is a software that provide some kind of indicators, color codes to the written material that been submitted to someone who will has the software. It's indicating the percentage of similarity in the given files matching the data base that the owner of the program. Educational facilities are using this kind of program to check for plagiarism with other students in the university and schools. Moreover, it has a percentage appears by the end of processing the data. The acceptance is varies based on the people preferences if they have mentioned some quotes and referenced correctly. That will allowed some match sentence is OK!. It has the ability to highlights some matching sentences and investigates accordantly.

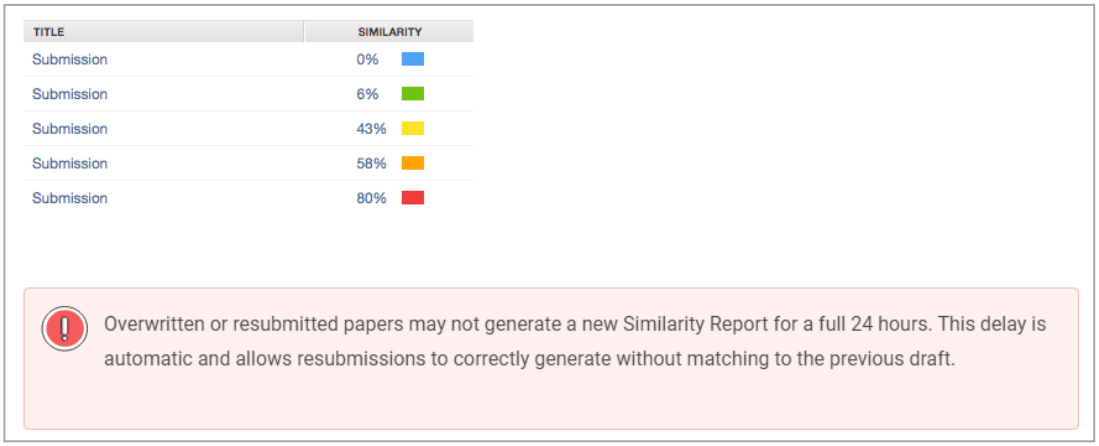


Figure-10 "interpreting the Similarity indicators color coding and notifications"

The similarity ranges are as followings, the blue is indicator to no match text. While having the green is indicator to have one word to 24% matching text. Moreover, the Yellow indicator is 25 to 49% and the orange is 50 to 74% matching text matching. Finally, the red highlight is having 75-100% matching text.[14]

Chapter 3: Methodology

In this chapter explains in detail the methodology that we took to formulate this project. We will take you through the process of formulating the features of the Design Approval smart application for installing the electrical connections in more details. We will highlight the both users for the applications: DEWA Engineer & the customers (Enrolled contractors and consultant). The following table will give brief introduction to the project.

The aim of the Connection services SMART App	DASA APP is an application for: DEWA employees: Design Approval Engineers – First line defense that will scan the submitted application highlight and comments in the major issues to either (Accept & reject) the application with clarification before the engineer have to review the case (based on the program integrated in the application) that will be discussed later in the project. DEWA customers (consultant & contractors): to increase the knowledge of the getting electricity submissions procedures and provide the updated rules in more advance way: phone notification.
Target Audiences	DEWA DA Engineers: to empower them with the technological tools to review and comments on the projects automatically. DEWA enrollment: contractors/ consultants. The application has private access to customers, who have to know about the updated rules/ regulations of DEWA in Connection services sections: NOC, DA, Estimation & Job order and Inspection.
Benefits will DEWA gets from DASA APP	❑ Alignment with DEWA strategy-2020 of Going smart, having available source of knowledge to all customers ❑ Increasing the smart adoption rate in the governmental sector ❑ Reduce the number of visitors to government centers ❑ Follow up with updated rules/ regulation on safety instructions due to the continues development of different types of projects

Table-1: The summary of the application

3.1 The application features for the DEWA employee.

The smart application that will be available for the DA Engineer will have many features.

3.1.1 Calculations of the three phase load:

One of the most important field in the application is the amount of the total connected load proposed to the project, which is normally depends on the customer needs and applied in the first step of applying for getting electricity. After that approval for the proposed load approved a paper called NOC will be issued and the contractor has to submit all the required documents to the design approval before start any work in the site. Refer Figure-2 Flow chart the process of applying application for the Fit-out application in DEWA. We will build our case on that example. Also, Calculating feature is already available in PDF acrobat, the code that will be through highlighting the format:

Sum1+sum2+sum3 …[15] (Acrobat) and appears in the concern field of the result

The result will be compared with the NOC TCL if it's equal or less. This part will be correct and no action required.

If the result > the NOC approved load (comparison) it's mean that the customer exceeds the accepted value and the case should be returned to the customer with the comment:

[Arrange to re-design the project with the approved load, or coordinate with the concerned department to modify your new load]

The reason of that strict rule is that the landlord, the owner of the project will have to pay for each (Kilo-watt per hour) and the amount of load required that been requested in the beginning by the contractor the value should be correct in order to process. Sometime the LV-DA engineers review the case and forget to check the TCL in the end of spending 40-45 minute reviewing the technical details he realize that the whole project should be revised back to the customer. Moreover, this option is to detect the correct value and compare it with the proposed load. It will be a beneficial tool to start up with our checking feature through first line defines.

if the TCL < or = the approved load correctly another examination called the balancing the three load required in the project

The electrical connection is AC connection: values in phase-R, Y, B should be almost equal values. The basic calculation can be applied to check the balancing is:

X1=R-Value;

X2=Y-Value;

X3=B-Value;

If(X1-X2<0.5)&(X2-X3<0.5) &(X3-X1<0.5); //0.5 is variable it depends in range (0 to 0.5);

"The phases are balanced" else, commented "THE PHASES AREN'T BALANCED"

In the case of protection we tend to locate the breakers rating (Ampere) to the circuit to avoid any faults in the lines, when the fault current happened the breaker will cut off the line in order to protect the circuit from burning. Having unbalance in the three phases in case of the motor connection might increase the chance of breaking the circuit in the start up phase of the motor instead of the actual fault. This might cause unnecessary shut down!

The following figure shows different types of motors through the starting and the running current modes

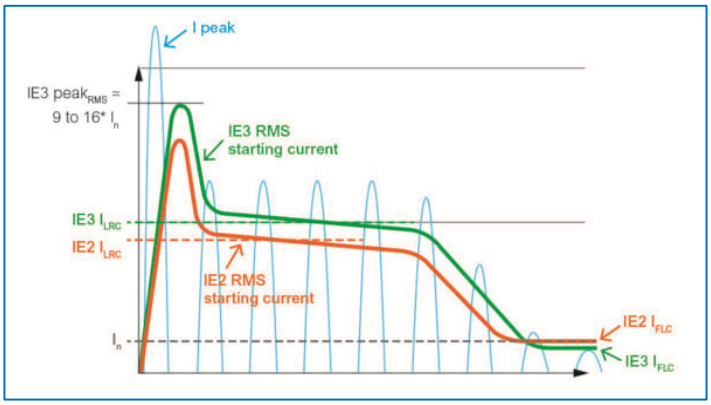


Figure-11 : Shows comparison of the higher starting current that been connected to one phase in the circuits – single phase motor example between two types of motors.[16]

3.1.2 The main meter location projects

If the file contains the sentence: "Meter location shown", the comment appears to the LV-DA is [Check the site setting for meter location, refer the NOC]; Which means if the LV-DA have this message he has to check the site setting and look for the Main meter location if

it's matching with the NOC, if not the application should be revise the routing cables again by the customer and comply.

The reason is because the source of the power that available for that project will be laying the cable to the closest place. This feature can be done by the coding and involving data base refer the Turnitin mechanism in detecting the values from the data base.

3.1.3 General action for different types of projects:

Coding required:

- If (TCL > 600 KW). The action is (Check for mobile generator provision?); If yes = ok , if No returned with comments "Arrange to provide mobile generator"

- If (TCL < 600 Kw) & type commercial. The action is: to check for Crane or machine or load >100 KW and highlight it for the engineer. Based on the data base such as the Turnitin® mechanism to detect from the data base

- If the "AC"/Air conditioning/Split Ac's/Window AC is written < 3 times in project>600KW. The Action check for the district cooling letter (note should appears)

TCL= Total connected load

3.2 The application features for DEWA customers

The application will have two interfacing, depends on the type of users, in case of the customers (contractor and consultant). Who need some guidance and updates on the rules and regulation in more advance way than email would be effective. Such as phone application notifications. We have established features in the application: Rules and regulations, Samples of ideal submission, Authorization letters, Frequency asked questions, Simulators, Notifications and latest update and Tracking.

3.2.1 Rules and regulations

This tool allows the customer to view the rules in more details and short video to assemble to the clarifications.

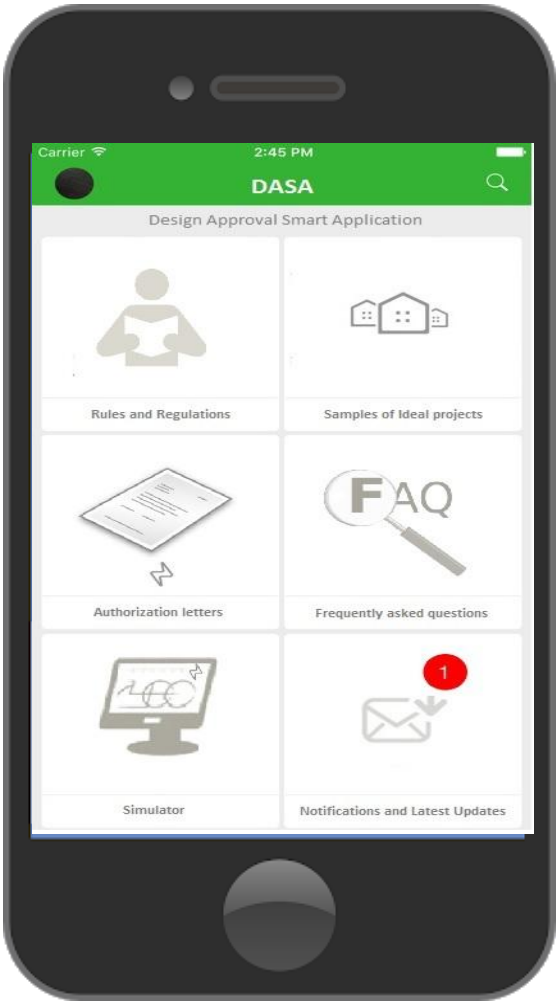


Figure-12 the design of the Application interface shown to the customers

3.2.2 Samples of ideal submission

Dubai considered as an open market for business, companies all over the world expand their work in the electrical connection in the city. Which means new companies that varies in background and knowledge. Moreover, the technologies in the world are always developed to new equipments and tools. The main reason for rejecting the projects from the first time is the poor of the knowledge to the process of the submission in the Dubai. With this additional platform they will have the ability to view and learn from the other types of projects that have the best filled of the requirements.

Projects are varies based on the need of the customers: Getting electricity, Modification with no change in TCL, Fit out applications and the renovations to the projects connection.

Types of projects: Commercial, Residential, both commercial and residential. The approvals requirements is to considered the facilities needed such as a public use places such as mosque have some different requirements than the park act. A samples projects of small load villa's, Big villas, Shopping malls, parks , commercial boards in the streets, bridges, hospitals, schools, library…ect in details will be attached for knowledge purposes.

3.2.3 Authorization letters

In some projects authorization letter is required from the owners of the buildings or the governmental sectors asking for permission to work. In case of having cables laying on roads or through a properties of other utilities. This option will list all the authorization letter and ready templates.

3.2.4 Frequency asked questions

We will be sharing some of the common questions and answers. Additional we will give a field for typing your own questions. That will allow us to update our platform with the ability to accept new question and enrich our data base.

3.2.5 Simulators

The simulator is the tool that allow the contractor to imagine the Electrical rooms that will fit all the equipments and understand the distance and clearance that been requested from the electricity provider company. This simulation can have multi options such as 2-D and 3-D and the fly in refer Figure-6 for the mechanism of IKEA Interface of the 3D fitting of furniture tutorial. It will have the same concept for adaptation of the electrical trench and cabling. Refer Figure-13

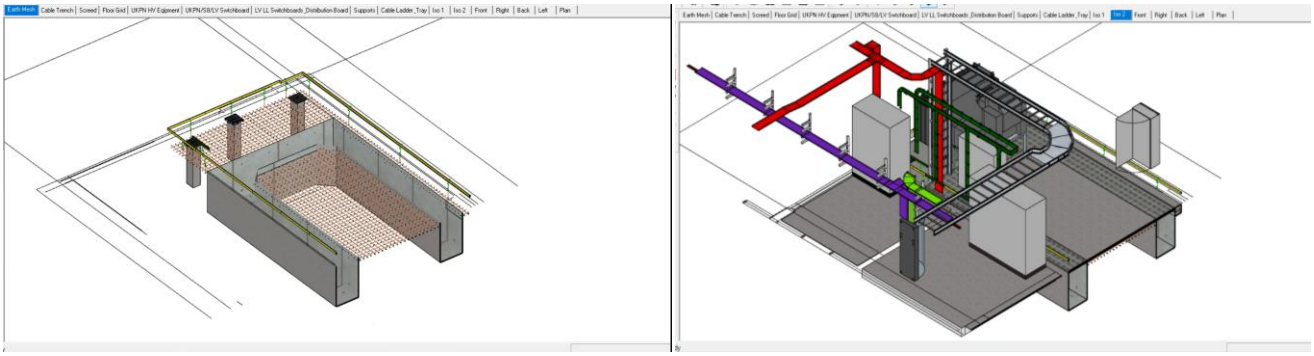


Figure13-Example Video of LV room implementation

3.2.6 Notifications and latest update

All of the updated rules, circulars and important tips will be shared as page to discuses all information that related the process of getting electricity and the governmental directions in the coming years.

3.2.7 Tracking

The submitted application have to forwarded to many section before having the final approval sometimes the customers need to know the states of his application. With small tracking system in the SAP he will be apple to detect his application statues and contact them directly if any delay or requirement clarification needed.

Chapter 4: Framework of the Project

4.1 The normal process of getting approval

Getting electricity procedure is simple as followings:

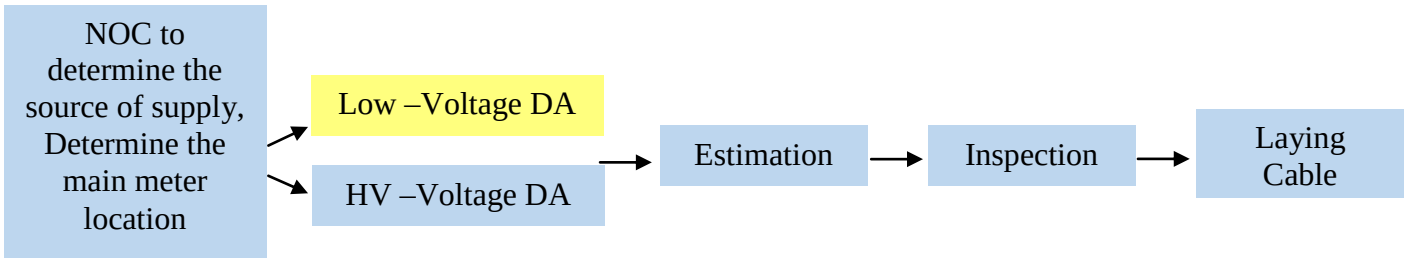


Figure-14: Getting Electricity procedure

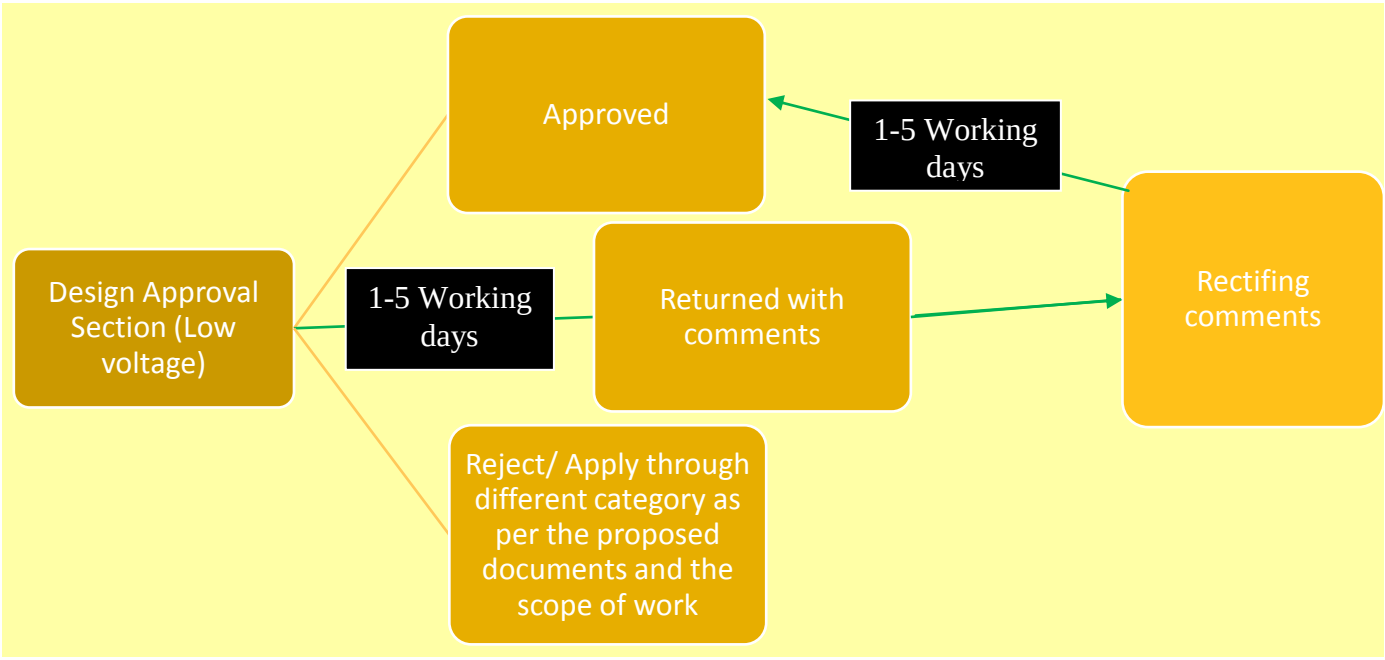


Figure-15: Low voltage design approval process of getting approval

From the above figure the submission have a quality procedure, once it's returned to the customer with comments. The application statues is "Returned to the customer actions" to rectify the engineers comments and validate the requirements.

After that in the SAP system the customer will have the ability to upload the necessary files again, and will located in the same engineer inbox for average time (1-5) working days to have the final approval.

4.2 The process of having the DASA system for the Engineers

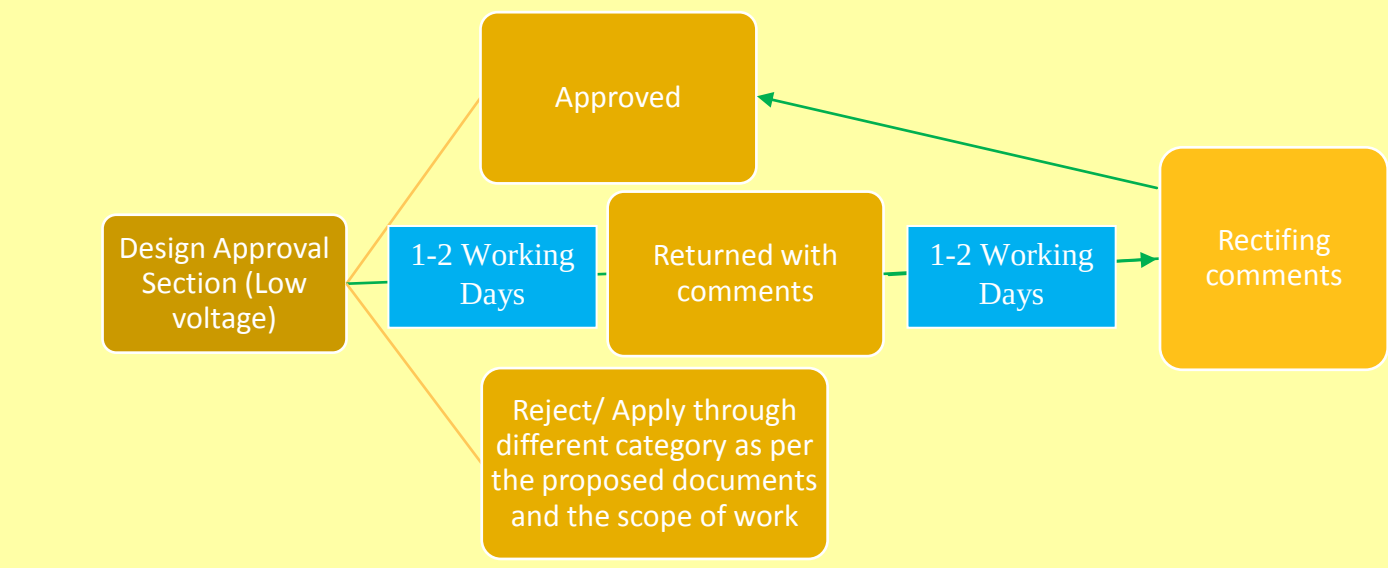


Figure-16: Low voltage design approval process of getting approval- With the use of DASA system

Figure-16 shows the getting electricity time line process for the returned cases. Refer to the usage of the DASA application. The first line defense to detect the major points and give the guides to the special engineer the final reporting for the missing figures and numbers and matching with the data base of the system (DEWA rules and regulations).

The time to have the approval will be detected to less than two days for the engineer to review with the help and support of the application. More over the second submission also, will be run through the application as the first time to ensure using the effective time for the LV engineer for decision making and finalize the approval.

4.3 The differences between the two scenarios

Figure-14 shows the process of getting the approval for the design in the normal situation, while figure-15 shows the same process with what will happen with the time period if the application of DASA well embedded and it can be more advance if we allow all the data we need implemented in the coding system. Continues update will guarantee the usage of the system to reduce the time for the customer to get the approval and start the project. Enhance more than 50% on the time frame.

4.4 The Customer educational channel through the system

Refer to the figure-14, if we consider the application is submitted through new electrical company. They will have the ability to look up to the application/customer interface and search about the ideal submission referring to the types of the projects and have clear idea about the similar project in Dubai in more advance way. The ideal project will have "help" tools to give more details about the technical issues and samples of letter that would be expected.

Moreover, the application will keep them up to date to any new circulars that issued in Dubai and involve them in the process of development and improvement through providing the same channel for feedback also, to track their application status easily instead of travelling to the government building by cars/public transportations.

Chapter 5: Analysis and Results

In this chapter we will focus in the outcomes of the project, how it's affecting the both users.

5.1 The outcomes of the project

The main reason that derive the need for the smart application in designing the electrical installations is the strategy of the united Arab emirates to adapt the high number of the AI and to be the capital of the world in the embedding the technologies and advance Artificial intelligence tools through its procedure.

5.1.1 Faster

Refer figure-15 the employee will have a automated system to check and review the case for the major defect and highlight the issues that he will be program to do depends on the type of the project and alert the responsible engineer to focus on. This tool will save much time and effort to the professional engineer.

5.1.2 The effectiveness and the accuracy

The Responsible engineer will start refreshing his mind by the application because; some of the senior engineer will get use of some kind of complicated projects. When he will get back to deal with the small and different types of project he will have to get back to the regulation and his own notes to refresh and remember some "comments" to be written. The application will have the automatic option to state all the regulation that the engineer need to refresh and remember. The submitted application will be clearly and more into the point after reviewing the cases by the smart application. Which will results in the more advance and ensure 90% accuracy and effectiveness comparing to the normal process.

5.1.3 The Productivity

From all of the above advantages, we can conclude that the system will allow the employee to finish more cases than usual. That will lead to increase the daily percentage of the productivity yearly and use effectively the company resources

5.2 Evaluation

By implementing such technologies to the government sector we are achieving the vision of the city of Dubai that offers a phenomenal experience to the customers. Through the

previous chapters we took you to a journey and answered questions: Why we need such application what would be the benefits to the utilities and the customers, and how we can create an application depends on the best practices company all over the world.

Government sectors are the nerves of the city's infrastructure that controls the building permits and serving the citizens. With application that can save time, effort and apply the technology that can be later learned and processed by the machines would be improvement and well decisions to make. Being the masters of technology by creating Successful business models will not last if there is no formula's of change. Applying change can happen if it affects the managements thinking and the high increases in the percentage of the technology adaptations continuously. Normally, what motivate businesses to change are the competitive threats or Business opportunities.[17]

Chapter 6: Conclusion

In the conclusions, we summarize the application as a smart gateway that will help to utilize the resources of the company in the innovative way. It will not eliminate the role of the engineer in reviewing the projects. It does will give him the powers and the opportunities to become a smarter and faster in his normal process. He will have much available time to focus on the decision making process. The Design Approval smart application will be available for both users the customers as the number one priorities of the government of Dubai and for the employee for assure the healthy and safety installations for buildings and properties in Dubai using programming and automations. It will enable the engineers in the concerned departments to have effective use of time and effort through having automatic first line defends reviewing the submissions of the electrical engineers contractors/ consultants.

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